# A Practical Guide to High-Frequency Antennas

***How does an antenna farm grow and evolve? Renowned contester and DXer K1TN takes you through the life cycle of his antennas from a couple of dipoles to a full-fledged contest station.***

**BY JIM CAIN, K1TN**

There are those who will tell you that antenna design and installation are sciences. Simply pull the right text book and follow the instructions. If something is amiss, a few minutes with a calculator will show you your error and where to make alterations. They would have you believe that nothing unexpected ever happens. I'm afraid that these poor souls have spent far too many years in the hallowed halls of academia and far too few in the real world.

If you are serious about setting up an amateur radio station, you will probably follow a route similar to that of the serious audiophile. He generally attempts to *empirically* answer questions about the merits of various components, which the serious ham often must also do for components that make up his station.

After decades of hamming (read practical experience), I'm convinced that antennas are second only to operator skill in predicting success of any given station. Let's say you call CQ on 20 Meter CW and somebody answers you down there in the mud; you just can't quite pull him out. There's QRM. He's too weak. Maybe you need new headphones (or the wax blown out of your ears). Then again, maybe your transceiver has a notch filter but no IF shift. Maybe you saved a few pennies by getting the factory passband filter instead of springing for the better — but more expensive — aftermarket filter.

Obviously he can hear you, but not vice-versa. Then again, you have a respectable signal; he may be using a QRP transmitter and bedspring for an antenna. Think about what you have to do to pull him through, to make that contact.

Or take the converse problem, which is much easier to solve intuitively. Your simple transceiver is hearing one of the big contesters, but you call him in vain. He has the best available equipment and big antennas, yet he can't pull you through. The reason is clear: your signal is too weak.

## The Big Question

There are two ways to get louder: first, you can buy an amplifier. Taking this route, you can then re-wire the shack for 220V; horse around with interfacing the transceiver and amplifier; give up the full CW break-in feature of running barefoot (unless you spend the serious money for a QSK linear); face the spectre of new — or exacerbated — interference to the neighbors' consumer electronics devices.

With an amplifier you also will: pay higher electric bills; put up with the drone of a blower fan; faint at the prices of replacement 8874 tubes; and slip a disc just moving the amplifier around the room. You can replace your small coax with bigger stuff. Maybe blow up your baluns.

Or, you can put up a better antenna! Now not only will the big gun be able to hear you, you won't have to buy new headphones and filters to try to dig out the weak guy calling you. This is the choice most people make, and it is one of the reasons why many people will purchase this *Buyer's Guide*.

Don't get me wrong — I am not anti-amplifiers. I am not a QRP fanatic. There definitely is a point where your antennas are good enough to hear most everything, where decibels come cheaper indoors than out.

The point is, one must weigh every improvement in station performance in terms of cost and hassle. But there is no doubt that $2,000 for a tower and a couple of beams makes infinitely more sense than buying an amplifier to feed your trap vertical, and amplifier manufacturers will be the first to tell you so.

## You Can Do It Yourself

Many of us, while having a fair idea of how radio works, how microprocessors control our transceivers and personal computers, what is the difference between Class C and Class AB1, and so on, still are loathe to dig into a busted multi-kilobuck radio when a service center is only a Federal Express call away.

Yet, we still can build, evaluate, trouble shoot, and improve antennas — ourselves. I wouldn't try to rebuild my transceiver, but I sure can prune a dipole, I can tighten guy wires, I can add radials, I can replace feedlines.

Antennas are one of the ham do-it-yourselfer's last frontiers. They may very well be what really separates us from the computer-video-audio hobbyist next door. And until antenna consultants decide to fly in for a week's worth of work at rates you and I can afford, it always will be that way. Come to think of it, who would want it any other way?

## Where To Begin?

You want to improve your present antennas or install new ones. Here are some questions that must be addressed:

- What bands need improvement?

## The 10-Meter ICBM

It's 1978. I have just purchased my first house and am so poor I have to charge a refrigerator to my MasterCard. I've been off the air more than two years, have sold all the giant hardware from the Superstation, but the sunspots are coming back.

Somebody loans me an old transceiver, and someone else offers me 65 feet of tower virtually free if I'll haul it away. Another guy is getting out of ham radio and has guy wire, insulators and preformed guy wire wraps at fire-sale prices. I see an ad in the local shopper for a 3-element CB beam and rotator for 75 dollars. I pay 50.

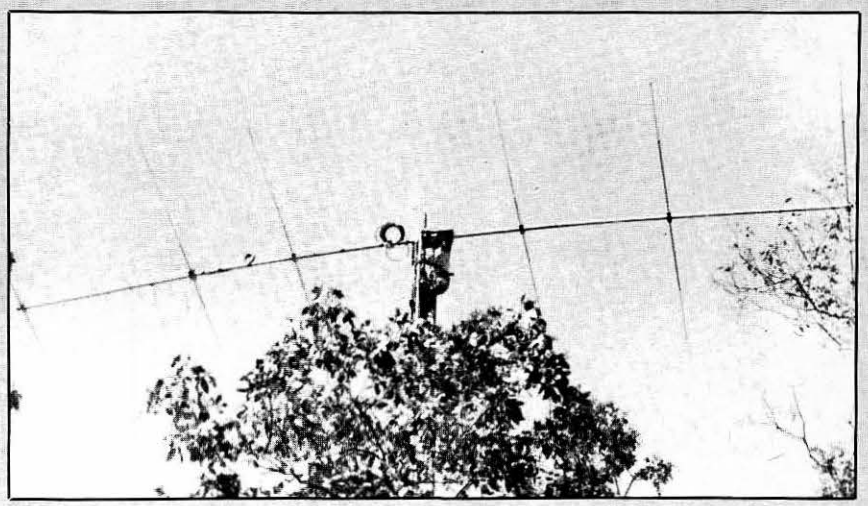
Up go the tower and rotator. Then someone offers me another CB beam. I find two wrecked TH6DXX antennas with boom sections still usable. I build a 5-element 10-Meter beam and have a ball.

Now it's 1980 and 10 is red-hot. I want to be loud. I have bought my own rig. I look at the boom sections: I have 36-feet worth. How many elements can I get on that? Write to the late, great W2PV; seven elements, he says. Down comes the 5-element. Out comes the ARRL *Antenna Book*.

Things are simple at this size: an element off a fraction here or there, who cares? Matching? I have a T-match from one of the trashed TH6DXX's. I use the original TH6DXX tilting boom-to-mast mount and boom-guy hardware. The boom is longer than a TH6, but the elements are much shorter and lighter.

I semi-fit everything together, to make sure all these scrounged parts will cooperate at the top of the tower. They will, and they do. The beam is up!

A name must be found for this aerial. I ask myself, what is bigger than a big gun? Why, an intercontinental ballistic missle, of course. The 10-Meter ICBM is named.



*The author prepares to put the final element on the 10-Meter ICBM. (Photo by W1XT).*

Did it work? Are you kidding? For an investment of about $300 I smoked the band, blew a hole in it, laid waste to the ionosphere, destroyed the Van Allen Belts. I was a threat to our planet's delicate biosphere.

Work JAs on long path? I worked W3s on long path!

On one occasion I turned off the transceiver, clip-leaded the keyer to the ICBM's feedline, and *worked six DXCC countries*.

But the ICBM was a little sharp on beamwidth. I would run stations in Tokyo for a while, then turn the ICBM to work Osaka. And when it came time to help the power company isolate a noise source, I not only pinpointed the offending pole, I told them which insulator was cracked. I was starting to get bills from local hams for replacement FETs in the front ends of their receivers.

The end came when I was talking to a station in South Africa: "You're S9 on my back-up vertical in the side yard, Jim, but only S6 on the tribander on the roof." So down came the ICBM. But, hey, I already had half the parts for a TH6DXX. And a couple of countries I needed were active on 20 but didn't work 28 MHz. They had not experienced the wrath of the ICBM.

(Thanks to K1FO for helping mix the concrete and W1XT for the photos).

- What are my precise communications goals on each band?
- How much property do I have to work with?
- Are there any restrictions on the use of my property?
- How much money and time am I reasonably willing to expend?
- Will the installation be "permanent" or more likely temporary?
- Can I perform all the labor myself or will I need help?
- Now re-think the above.

### What Bands Need Improvement?

This is a very personal question, which every ham faces and must answer for himself. Here are two very simple examples:

First, suppose you have a vertical and can't work close-by friends on 75 Meters any time, and can't work anybody within 500 miles during daylight on 40. You do OK on 20, 15 and 10 during the day but have to wait out the pileups.

This is not a primer on wave propagation; that's what antenna books are for. You know a multi-band vertical is an inexpensive, effective compromise, but it is just that—a compromise. You need a (low) horizontal antenna for close-in work on 75 and 40 during the day, the same on 75 at night. A beam will help immensely on the higher bands.

Or, perhaps you can't hit (or even hear) a repeater from your apartment; you need a fixed beam pointed at the machine, even if the beam is nothing more than several pieces of wire in a Yagi configuration taped to the wall of your bedroom (trust me—these work).

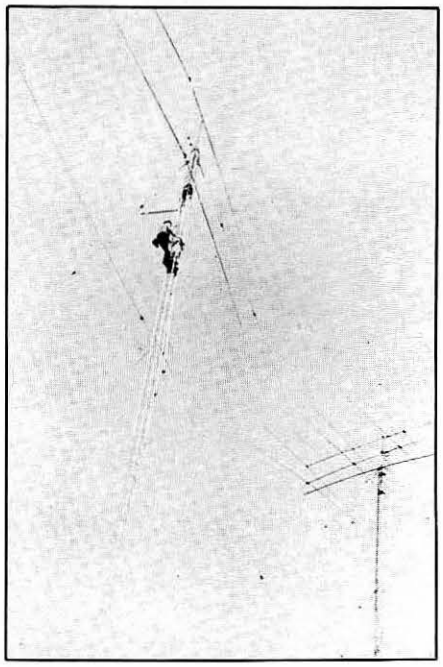
Think about exactly what it is you want to do, and set some priorities. You can't put a half-dozen antennas on one small mast. Weigh alternatives, ponder what really is important to you. Consider the effort and expense necessary to meet your goals. Decide how much is worth it to you.

### How Much Property? Any Restrictions?

Every audiophile's goal is to design the perfect listening room, then add a house around it ("bathroom?—oh, yeah, I almost forgot"). In a like manner, serious hams stock up on topographic maps and go looking for acreage at low prices, with good ground conductivity, in municipalities that look the other way at "adjacent structures" (towers).

Some of us, however, have different priorities. Face it: if you are on a quarter-acre lot with a hyper-active zoning board you are unlikely to be king of the band, any band.

If you are unsure of your legal position, then get the necessary information, and get good help. Another article in this



*Assembling a KLM 4-element 40 Meter Yagi, May, 1977. In the background is a 110-foot Rohn 25 tower with 4-element 20, 4-element 15, and 5-element 10 Meter Yagis. (Photo by K1ZX).*

*Guide* deals with this subject and was written by Dale Clift, NA1L, who is one of the nation's top experts in this area.

## How Much Money And Time?

By setting goals and priorities you pretty well already have determined how much you are going to be willing to spend in time and effort. For example, say your goal is to make the DXCC or CQ DX Honor Roll. Paul Rockwell, W3AFM, made a strong case over 20 years ago, a case still valid today, for being loud and consistently active on one band—20 Meters. This means having a sturdy monobander that won't fall down the day before a "new one" comes on.

By putting up a monobander instead of a tribander you have locked yourself out of 15 and 10 Meters. But every rare DX station and new country always shows up on 20 Meters. A specific goal has determined your choice. As for the cost, again, priorities dictate your choices. If you are willing to do some maintenance and to risk weather damage, you can put up bigger antennas, more cheaply constructed antennas, use inferior coax, and so on.

If you want a set-it-and-forget-it antenna system, you will have to spend more on superior products. In other words, you will do it right, and you will pay for it. Fortunately, amateur products such as towers and antennas generally are priced according to quality of materials used in their construction. Most long-lived products have established their worth and are well-known.

Time? That's up to you — are antenna projects recreation or work?

## Permanent Or Temporary?

Maybe I am overly sensitive to this question because I am a rolling stone. But still it is worth giving some thought to, I think.

Antennas do indeed come down more easily than they go up (it's called gravity). But they are a chore to relocate, especially to another state or halfway across the country. They are not items sold easily or quickly in the marketplace, either. Have you ever seen tower sections at a neighborhood tag sale?

Someone a thousand miles away may desperately want your monobanders, but the logistics of getting them to him can be overwhelming.

If you are renting, of course, you will have to check with the landlord before doing much of anything, even semi-permanent. And even if he says, sure, go ahead and pour a tower base and put up a hundred feet of tower, do you really want to go to the trouble in such a temporary situation? Probably not.

Even if you own the property, consider how you are going to hide or remove that tower base come selling time. You can't exactly dig out a 2-cubic-yard chunk of concrete with a garden spade.

This question ultimately is related to the one about money: a permanent installation suggests longevity and structural strength, which means more expensive. Sort of like getting a mortgage that's loaded up front: If you stay a long time, you win. If you bail out too soon, you lose. Don't pay for 10-year antennas at a 2-year house.

## Do You Need Help?

Other hams, perhaps more experienced, often can be found to assist with antenna projects. Most rightfully expect someday to be helped in return, if the need arises. Professional antenna erectors can be hired, but they generally are very expensive.

If you are unable or unwilling to do certain antenna work, then when it comes time for maintenance you are at the mercy of others. Do you want to be off the air for months because your driven element has broken and you cannot climb the tower to replace it?

My rule is, if I can't do the work myself the project is too big. By doing my own work I know exactly how it was done, and know I am able to fix things that break. Even at 3 a.m. during a contest, if necessary.

But don't be embarrassed to ask for help if you need it. We all are in this together, after all.

## Finally, Some Recommendations

One of these days I may settle down, again, and decide to build a decent HF station. Since I am interested in DXing and contesting, I would put up my antennas accordingly. Here is what I would have: Two towers, each a hundred feet high, spaced at least 150 ft. apart. Identical heavy-duty rotors and masts in each. A 5-element 15-meter Yagi over a 5-element 20 on one tower, and a 5- or 6-element 10-Meter Yagi over a full-size 2-element 40 on the other. I would hang a plain old 80-Meter dipole between the two towers, then experiment with various wires for 80 and with shunt-feeding one of the towers on 160.

The towers would be of the standard, guyed variety. I would not use rotatable cubical quads because they are too fragile for my taste. I would use "hardline" to as close to the antennas as I could get, then half-inch coax the rest of the way.

If I were limited to one tower (because of lot size, lack of funds, etc.) I would make it 70-ft. tall with a big tribander and 2-element 40 on top, and inverted Vees for 80 and 160. In this situation, I would seriously consider a high-quality, steel crank-up/tilt over tower or rotating pole.

On a really minimal budget I would have a vertical for 20, 15 and 10, with miles of radials, and a 135-foot centerfed with open-wire feedline and a transmatch for 80-10 Meters.

## Hamfests And Flea Markets

The used market is an antenna builder's dream. Though many of us are reluctant to buy an "active component" (anything that has to be plugged in and checked out) at a flea market, passive components such as antennas are easily evaluated on the spot. It even is possible to, say, open up a transmatch and judge it by looking at the condition of the coils and switches.

But it also is possible to be tempted by a bargain-priced part that may never get used. Of course, this is what basements and garages are for.

One thing to beware of on the used market is coax. If the printing on the outer jacket is smeared or completely gone, look out! Use your trusty knife to cut back some of the jacket and then examine the braid; if it is not shiny and clean, walk on.

Otherwise, almost anything goes. You can tell if tubing is straight by laying several pieces side-by-side. Bolts and nuts

## The Magic Dipole

The Magic Dipole continues to taunt me, more then ten years since I last used it. The Magic Dipole worked much better than it had any *theoretical* right to. Just ask anyone DXing from the Northeast in the mid-1970s — all will admit to having waited in line behind The Magic Dipole.

The Magic Dipole was 135-ft. long, about 60-ft. high, and center fed with about 80 feet of open wire line. It was broadside NE/SW and hung between a 60-ft. Rohn 25 tower and a tree, clear of surrounding metal such as other antennas, guy wires, and power lines.

The ground over which it hung was part of the yard of a rural building lot created by filling in swampland. The accompanying photo shows the virgin swamp behind the house; it was taken in the winter of 1974-75. The swamp dried up only during periods of extended drought.

The topography around The Magic Dipole was superb, with great views and substantial drop-offs in all directions, especially toward Europe and Asia. The location was unearthed by W1ARR and K1ZND (now K1ZZ) around 1970, and I moved in when they moved out late in 1974. They had done their homework well.

Although later years brought higher towers and more sophisticated antennas, The Magic Dipole continued to serve as a reference. It was better into Europe on 40 Meters than a loaded, 2-element Yagi at the same height. In directions in which it had substantial lobes it was equal to or superior to a 3-element triband Yagi — at the same height — on 10, 15, and 20. But its real forte was 80 Meters.

*The Swamp beneath the Magic Dipole, winter 1975. Wire around tree is a safety wire for a nearby guy anchor.*

Toward the end of my stay at "The Residence," the 60-ft. tower grew to 110 ft. and held, among other things, three individually fed sloping dipoles for 80. These had, by definition, low radiation angles, and the three showed consistent front-to-back, probably because the 110-ft. tower with several big Yagis on top acted as a half-wave reflector for each of them.

These slopers were good performers, regularly breaking contest pile-ups with ease. Yet the northeast sloper never outperformed The Magic Dipole, except occasionally on the longer Scandanavian/UA1 path, despite being at twice the average height of The Magic Dipole. The sloper seemed to generate bigger pile-ups from contest CQs, yet its performance was unpredictable — flaky.

On the other hand, The Magic Dipole was consistent; you could talk to Europeans for hours on 75 with nary a waver in signal. If you talked long enough, VKs and ZLs would begin breaking in. As you would expect on that longer path, the SW sloper would be louder. But it was The Magic Dipole that attracted the Pacific stations in the first place.

After much speculation by both its users and its victims The Magic Dipole's outrageous performance ultimately was laid to some relationship between its height and the true ground beneath. Not only was the water table very high, one look at the house's porcelain fixtures told you that the water was saturated with iron (we drank bottled water).

Was it a coincidence? The Magic Dipole's height was 60 ft., almost precisely a quarter-wave above ground. The actual radio ground was probably right at the surface, owing to the makeup and position of the ground water.

Or was that particular radio location such that The Magic Dipole—basic, unassuming, and not very high—simply was the "right antenna"? One can only speculate on these matters.

But no speculation is involved in asking Europeans who had the outstanding 80-Meter signal from the Northeast at that time, nor is any required of the other stations that fell to The Magic Dipole. This is for certain — when an antenna like The Magic Dipole comes along, you know it almost from the first time you use it. And you never forget the experience!

either thread easily or they don't. New aluminum is shiny, weathered aluminum is dull.

## Research

Most tower and antenna manufacturers will provide a detailed specification sheet on request. That information was used to compile the product tables in this manual. I suggest going even further and getting the complete installation manual, even if you have to pay dearly for it. You may discover from the manual that installation of that dream tower is for some reason impossible at your location.

About gain figures: take them with a grain of salt. At best they are comparable only within each manufacturer, if one assume that manufacturer uses the same method of measurement. Otherwise, a good rule of thumb is boom length equates to gain, given adequate spacing. Beware or too many elements for a given boom length, e.g., 5-element 20-Meter beam on 25-foot boom.

I sold a 2-meter Yagi to a new ham not long ago; his first question was how much gain does it have? I said I hadn't the faintest idea, and I didn't. I told him it was made by a well-known outfit, had been on the market for years and thousands were in use, it looked properly spaced (you get an eye for such things), and was solidly constructed. I told him I had worked 1,400 miles on Tropo with it, running 10 watts. He bought it (both my line and the beam).

Read carefully and ask questions of more experienced hams. They know what works and what doesn't. I know a guy who bought the Rohn specification manual, then proceeded to put up 90 feet of Number 25 tower with four sets of guy wires, because he read the wrong page of the book. The guy wire requirements table he used were for something outrageous like keeping up that 90 feet with about 20 square feet of antennas on top, in a location subjected to the most severe icing conditions and near-hurricane force winds!

## More Hints

Here are just a few ideas I have picked up over the years. Nothing here is meant to be complete or comprehensive. Rather, this may encourage you to read the many helpful books available on antennas and towers, and to talk to more experienced hams.

One of ham radio's great thrills is the first time you hear a low-frequency band on a parasitic array. That tribander looks great and really works, too. But don't for a second think it is as good as a monoband beam. The difference between a tribander and a monobander isn't as great as between a tribander and a dipole or vertical, but it still is substantial. Don't kid yourself.

*Time out. The author takes a break at the 40-foot level before hauling up another section of tower. (1975 photo by K1ZX).*

When you get your antenna, clean everything. Check for burrs and aluminum dust where the tubing has been machined or drilled. Assemble the thing on the ground, even if you ultimately plan to put it together on top of the tower, to ensure everything fits. Be sure to use plenty of the conductive grease most manufacturers supply, so the antenna will come apart easily when you take it down.

Coat everything with the best protective product you can find. Don't use Krylon® spray or electrical tape; they last about six months, at best, in the weather. Coat electrical connections, nuts and bolts, matching networks, and the little rubber tips on the ends of the elements and boom.

If stainless steel hardware is an option on your choice of antenna, get it. Otherwise, get a complete set of stainless hardware from one of the sources who advertise in the magazines. Throw the "plated" hardware away or use it for something else, like a clothesline.

Get a concrete contractor to pour your tower base and guy anchors, unless you are seriously into heavy labor. Even more important, purchased concrete is likely to be stronger than what you mix yourself. Be sure to use reinforcing bar in your concrete base, even if the specifications don't call for it.

When you install your rotator, put a multi-pin plug and socket in the cable line about two feet or so down from the rotator, and seal it thoroughly. Then, if your

## Confessions Of A Wimp

Maybe some people just naturally confront their first tower, then climb it, never looking back. Not me — I was a wimp.

In my boyhood hometown, where I began life as an amateur Novice, towers were commonplace. The nearest VHF TV broadcast stations were 40 and 65 miles distant and a 40-foot tower with big log periodic Yagi and rotator were standard equipment in nearly every household. They were pretty chintzy towers — thin-wall tubular steel construction. But they were self-supporting and, with their tiny loads on top, survived everything short of a tornado.

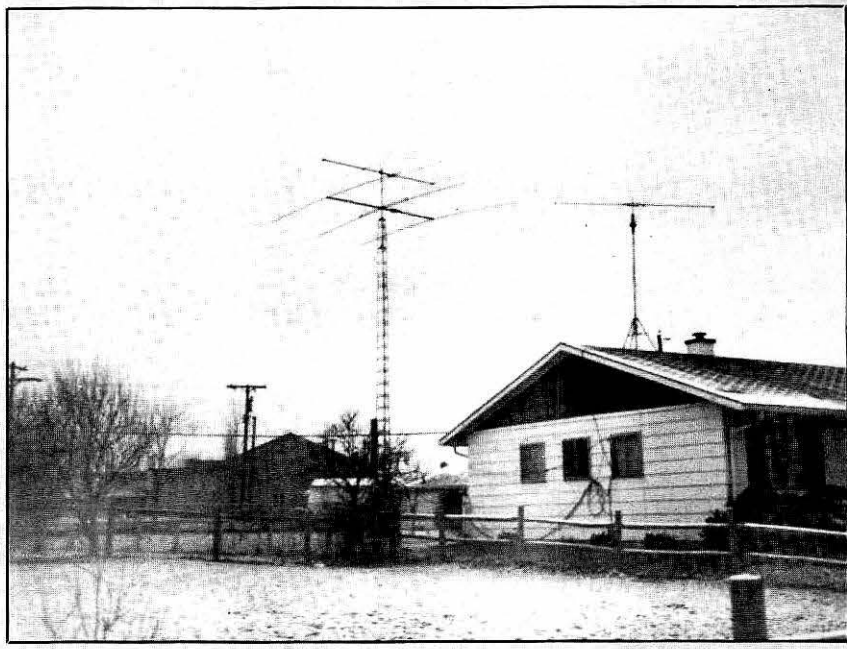
My novice home had one of these towers, and I climbed most of the way up it to hang my first wire antennas. I was 12 years old and always did this when Mom was away. I wasn't petrified, but I wasn't exactly comfortable, either.

The next house didn't have a tower. Rather, the TV antenna was on a rooftop tripod, which I also used for hanging wires. One day it occurred to me that the roof actually was more frightening than the tower — steeply pitched and slippery. If I lost my footing there was nothing to hang onto.

The third house (we moved a lot) had another tower, 40-feet tall, and by this time my General Class license "absolutely necessitated" a beam antenna. I was 15, taking lots of math and physics courses, and my Dad, figuring an engineering degree and high-paying job were in my future, decided to go along.

We could move the TV antenna down onto a sidearm and put a 2-element triband quad on top, I reasoned. At this point I didn't own a safety belt and my tower experience amounted to no more than climbing up, hanging on with one hand and tying the ends of dipoles around a tower leg with the other. (This is why most hams are pretty skilled at one-hand knot tying!) When my Dad saw the quad assembled on a piece of pipe in the yard he naturally was curious about how I intended to get it to the top of the tower.

I had no idea.



*The author's first real tower and beams, Indianapolis, 1974.*

Dad, wishing to protect his 15-year investment, said he'd get the TV installation guy to do it. He did, and the job went off without a hitch. "A lot bigger and heavier than a TV antenna, but no sweat," the TV guy observed. He climbed the tower with one hand, holding the 50-pound or so quad in the other, then belted in when he reached the top, and put the boom on the mast.

Only years later did it occur to me that he was out of his mind.

That tower blew down in a severe windstorm, and was replaced with a slightly taller one. A different TV guy put the new quad up — he finished the job, climbed down, said a few colorful words, and swore never again to tackle an antenna that big.

Only years later did it occur to me that he was pretty savvy.

Fast-forward six years to 1971: I am out of college, renting my first house, and ready for some beam antennas. I am in Indianapolis, with plenty of local big-time

DXers full of (mostly good) advice. Good friend W9ZTD works for a radio supply store, and orders me a Spaulding HDX-40 tower with screw-in anchor base. "You can pick up the whole base and move it with you," Les said, and he was right. I later moved it all the way to Connecticut and used it there.

But I still wasn't into climbing. The tower would hinge up from two of its base bolts, so I put the whole thing together on the ground, then mounted the rotator and mast. A friendly local sold me two Yagis: a Telrex 3-element 20 and a Telrex 4-element 15, for a hundred bucks each. "Telrex," incidentally, is a not-so-vague euphemism for "heavy."

Well, I propped up the tower enough to be able to mount both Yagis on the mast, from a step ladder. I know — this sounds so crazy it must be true! I then commissioned (actually, bribed with a 6-pack), a friend with a big Detroit V-8 car (I had a Fiat). We tied a heavy rope to the tower, passed it over the roof of the house, and attached it to his trailer hitch.

To this very day I cringe just thinking about this. But the tower swung right up into position, the third base bolt slid right through, and here it was: my first dedicated amateur radio tower.

Did it ever look fine (see accompanying photo).

I added the little 3-element 10-Meter beam, a lightweight CB special, later, myself. When the time came to take it all down, though, I wasn't prepared. The 15-Meter Yagi, on top, was out of my reach (only later was I to overcome the fear of belting onto the mast itself), and both the 15- and 20-Meter beams were a lot heavier than the CB special. Luckily, a local guy who did antenna work for many of the Indianapolis hams was available and made quick work of taking down the beams and tower.

I remember his name was Dick, but at the time, "Fearless" was what I called him.

The tower was moved to Connecticut. In early 1974, we put it up at another rented house. I was learning — I put the tower together on the ground again but, this time, three of us merely got underneath it and walked it into position. It weighed only about 300 pounds, I think. Whether or not we could have done this with 200 pounds of rotator and Telrex antennas on top is a matter of conjecture.

And here is where I finally overcame most of my tower fears. I belted onto the top of the tower (after earlier mounting rotator and a short mast) and, while two experienced tower men shouted encouragement from below, pulled up a Mosley Classic 33 tribander on a rope. To me this was, at the time, a heavy antenna — it weighs a good 60 pounds, and I weigh only 140.

"This isn't going to work," I moaned pitifully. "What do I do once it gets up here?"

"Grab it by the end of the boom," Fred Lass, K2TR, advised from his comfortable position lying on the grass, well away from the tower. "Forget the rope, grab the boom, pull it up until it's balanced, let it swing over to horizontal, and lay the boom across your safety-belt lanyard."

I thought of the day I gave up stamp collecting to learn Morse. I thought of the beam lying on the ground in twisted, broken scraps of aluminum. I thought of my body lying on the ground in twisted, broken scraps of flesh and bone. I thought of how I'd neglected regular church-going. I thought of how much DX I could work with dipoles.

I was too young to die.

Of course, Fred and Rick Niswander, WA1PID (now K7GM) were right. I could handle the antenna. Once it started to find its balance point it seemed not nearly so heavy. I laid it on my lanyard and actually took both hands off it, leaned back, and heaved a sigh of relief. This gave me time to inspect the boom-to-mast plate, with U-bolts already in position, and think my next move through.

Pick up boom on either side of boom-to-mast plate, lift up over top of mast, then lower until U-bolts encircle mast.

No sooner said than done. Rick and Fred applauded, knowing that, at the advanced age of 25, I had surmounted a great hurdle. Like a marathoner, I had hit the wall, and overcome it.

In the next few years, as new Rohn 25 and 45 towers went up and grew, I learned more and more: You can climb much faster and more safely with gloves and the right kind of shoes. I learned how to work together with someone else on the tower; how to keep from dropping things; how to assemble big beams at the top of the tower, one element at a time; how to make gravity and leverage work for you instead of against you when handling antennas weighing as much as you.

I learned that gin poles are fine for pulling up tower sections, but I also discovered, first, that two people easily can put a section of Rohn 45 in place without a gin pole and, second, that I could, if necessary, pull up and put into place a section of Rohn 25 (55 pounds, 10-feet long) by myself.

I learned that some people do not know the difference between a box-end and an open-end wrench, and that the best "ground helpers" are those people who know what it's like to work at the top of the tower (my friend W1GNC being a major exception to this maxim).

Along the way, I joined a select fraternity of men (and, yes, women) who do tower work. But most important of all, I overcame first a fear, then merely an uneasiness, over working at great heights. In later years I would tell people I felt safer belted onto a guyed tower than crossing a busy street. I still feel that way.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The Pro-Am H.F. mobile series are heavy-duty, slim line construction, designed for the H.F. Amateur Bands, 75M, 40M, 20M, 15M, and 10M.

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| Model | Band | Model | Band | |
|---|---|---|---|---|
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| PHF40 | 40 Meters | PHF12 | 12 Meters | 5 ANTENNAS . . .10, |
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**Model ABR20, Component**
20 Meter Resonator.

**Model ABR40, Component**
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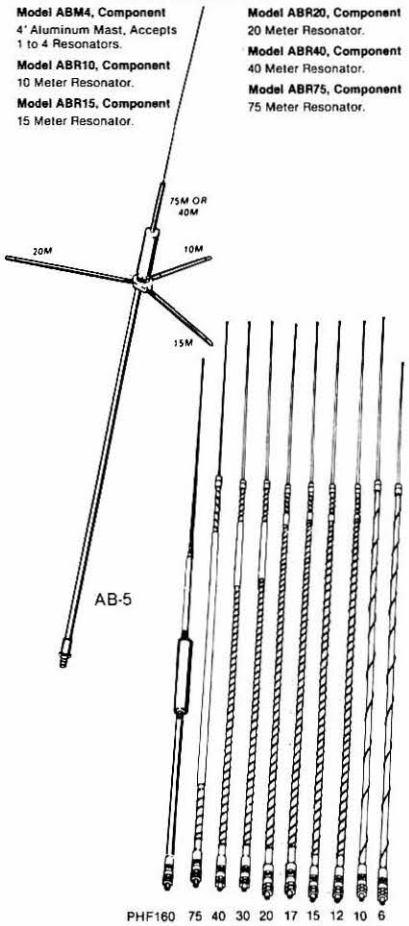
**Model ABR75, Component**
75 Meter Resonator.

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## An Unsolved Mystery

There's always something to learn, some new experience, in the antenna game. A friend of ours learned that not long ago. When he came to us for help we were at a loss to provide an explanation.

Seems like this guy, with almost 30 years of hamming under his somewhat expanding beltline, recently had moved to Florida and was living in a rented suburban house. "It's a so-called 'double lot,' Jim, but sure isn't much room by Connecticut standards." Bound to at least get something on the air for the November contest season, our friend proceeded to plant his trusty vertical next to the pool.

"I marked all the settings before leaving Connecticut, and reassembled the aerial exactly as it had stood for nearly four years up north," our friend reported. "The sandy soil was so pourous I didn't even need a hammer to pound in the 4-foot ground rod; I just twisted it all the way down by hand. Then I rolled out a half-dozen 33-foot radials and snaked a couple of longer ones around the house and into the front yard for good measure. "Just about like the set-up I'd used at home and on Field Day up north."

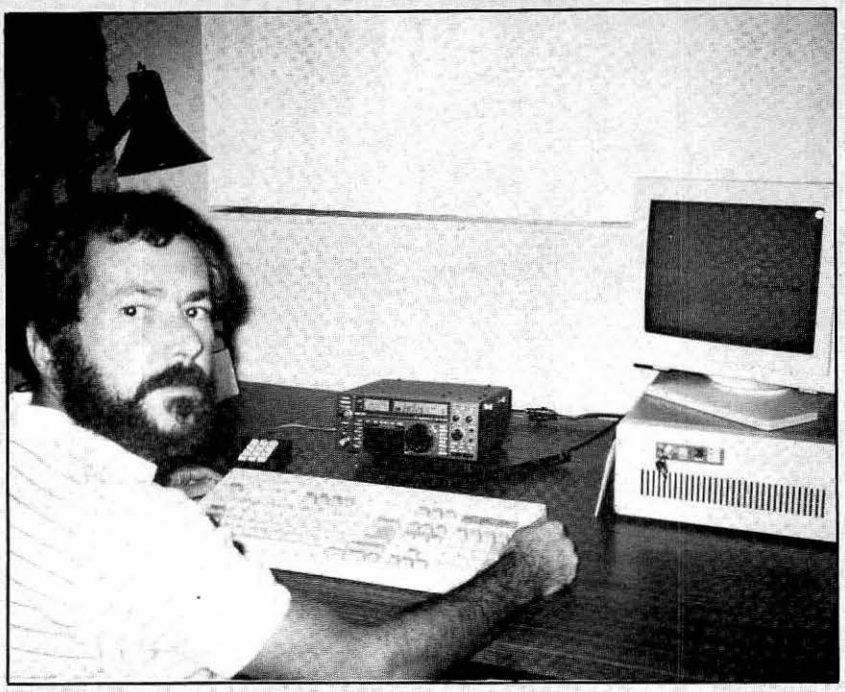
It doesn't take a mind reader to know what came next. "Jim, the darned thing just didn't work at all, except for 20 and a little on 40. Nada on 80, and the settings on 15 and 10 were 'way off, too. The resonant frequency on '10 Meters' was about 26.5 MHz."

"The manufacturer was right on the nose with their suggested settings when I put the aerial up four years ago, but I had to change the coil settings on 80, 40, and 30 Meters. We're not talking inches, here, we are talking whole coil turns!"

What about the ground? I asked him, and did he check for a bad piece of coax, a bad connector? Did he maybe have one 807 too many before putting the antenna together? Had he connected the center conductor to the ground rod?

But this wasn't funny, as I understood when he told me what it had taken to bring the vertical up from 26.5 to 28.4 MHz — instead of the suggested top extension of 25 inches (which sets the 10-Meter resonant point and very slightly affects tuning on the other bands), the extension ended up at four inches!

And the stub-tuning wire, which runs down the side of the vertical and sets the 15-Meter resonant point, had to be lengthened — just the opposite of the massive change to bring 10 Meters home.



*The author uses 1988 gizmos to operate a CW contest. There may be a personal computer, microprocessor-controlled transceiver, and K1EA Contest Program software inside . . . but outside, a quarter-wave vertical represents 100-year old technology. (Photo by KA1DTV).*

I then focused on the ground system, reminding this poor, confused ham that his "ground" really is just a beach with a layer of "St. Augustine grass" struggling to survive on top. (Northerners, incidentally, call it crabgrass.)

"But you know why nobody down here has a basement, Jim," he retorted. "I figure the water table is only down a few feet, so verticals should work like bandits here."

Well, I'm no antenna engineer, but by talking to a few of the locals I had learned that verticals "act funny" in these parts. I suggested our friend try some more radials, resonant on 15 and 10 Meters, and tying into the house water pipes (even if that meant a long wire run from the ground rod to the nearest outside faucet), and even running a piece of heavy wire into the swimming pool.

A week or so later we heard back from him: "I did all those things. The antenna does seem to get out better now, and people actually can hear me on 80. But none of the settings changed; the antenna still is almost two feet shorter than it is 'supposed to be' and it still works better when it's raining. I give up." Actually, he didn't quit trying. We saw him at the plumbing supply store the other day, carrying out a 20-foot piece of copper water pipe. "I'm going to drive that sucker down until I hit water, and then drive it some more," he told me. "If that doesn't work, I'm going to buy a mast and mount the antenna above ground and see if it works as a ground plane. Going to get me one of those resonant radial kits and make my own ground."

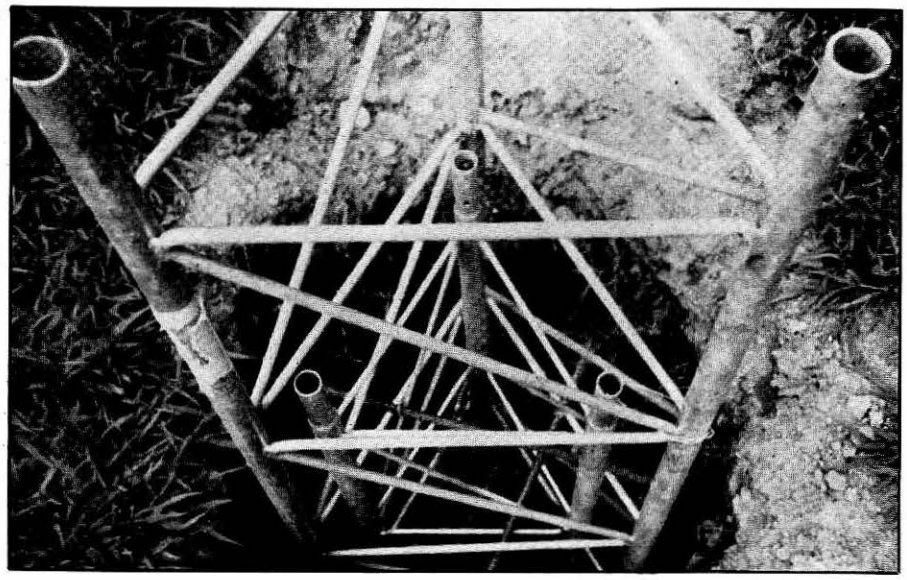
"But the antenna is working pretty well now isn't it?" I asked rhetorically.

"I guess so," he admitted. "Ran a bunch of JAs on both 10 and 15 in the last contest. And the SWR is nice and low on all five bands. But the book says make the top extension 25 inches, and I'm going to get there if it kills me."

rotator breaks, you can take it off the tower without having to disconnect the cable right at the rotator. Do the same thing where your cable meets the control box so that, during electrical storms, you easily can disconnect and ground the cable in the shack. More people have had shacks (and entire houses) wiped out from lightning sneaking down their rotator cable than from direct hits on power lines.

Use "preformed" guy grips instead of cable clamps on your guy wires. Not only are they easier to use, they won't snag those dipoles you plan to pull up the tower later, and they won't work loose like clamps. And do use torque brackets on your guy wires—they are an extra margin of safety.

Use a thrust bearing if at all possible. My rule is to have (at least) an equal length of mast inside the tower as outside. I shudder every time I see an installation with nine feet of mast outside the



*Idea: Put two tower bases in place before pouring concrete, in case you change your mind later. Note use of reinforcing bar, wired to base sections.*

tower and the rotator about a foot down inside the tower. Think of the mast as a lever. Think of a 9:1 ratio. Think of the bearings in your rotator. And think of the coldest, iciest, windiest day of the winter.

Just because some manufacturer puts the rotator cut-out at the top of the tower doesn't mean they know everything. Find the spot you want the rotator, hacksaw away one diagonal brace, install the rotator plate and rotator, then bend the diagonal back into place and put a stainless steel hose clamp around it.

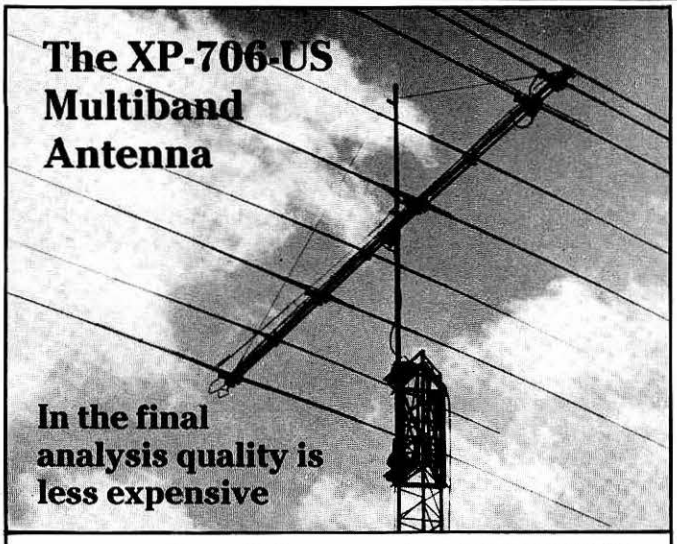
Be careful about where you locate your tower; trees grow, and towers sometimes have a way of growing, too. Even if your tower is going to be twice as high as surrounding natural objects, envision yourself trying to pull antennas up through tree limbs. And you may not be interested in 80 or 160 Meters now, but what if someday you get an urge for those bands — and your tower is in the corner of your property instead of the middle?

## Beauty Is In The Eye

Only a ham thinks a tall tower with stacked Yagis is a thing of beauty. A non-ham spouse is likely to at best only tolerate such things. Your neighbors will hate them. Squirrels will eat your coax, if you don't manage to chew it up with the lawn mower first.

You may have to face a zoning board to get what you want up in the air. You may want additional insurance on your installation, an on-going expense. The first time a really big wind blows you will probably suffer a Class A anxiety attack. And it is well known that Murphy wrote his Law shortly after putting up his first tower and beam.

So, after 27 years of this nonsense, I've decided to get out of radio completely and give the backyard back to gardening. Just as soon as I try another half-dozen radials on the vertical. I was reading somewhere that . . . .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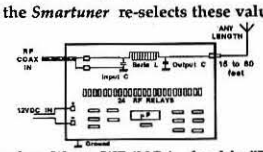


Still skeptical? Write Gordon West, WB6NOA, for his "Best Coupler Ever Tested" review of the SGC Model SG-230 *Smartuner.* Or, better yet, send $10 (refundable with purchase) for a copy of the instruction manual.

**salt water please!*

Write Gordon West, WB6NOA , for his "Best Coupler Ever Tested" Reviews of the SG-230 Coupler and the name of your nearest dealer.

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